rm-Up #1

urvey of cars in student and staff parking lots at a large versity was taken with the following results.

	Student	Staff	Total
American	107	105	212
European	33	12	45
Asian	55	47	102
Total	195	164	359

What is the probability that a car is from the student parking lot?

$$P(Stu) = \frac{195}{359} = .5432$$

What is the probability that a car is of American origin?

$$P(Am) = \frac{212}{359} = .5905$$

What is the probability that a car is of American origin and a student car?

$$P(Am \text{ and } Stu) = \frac{107}{359} = .2981$$

What is the probability that a student car is of American origin?

$$P(Am|Stu) = \frac{107}{195} = .5487$$

What is the probability that an American car is in the student parking lot?

$$P(Stu|Am) = \frac{107}{212} = .5047$$

	Student	Staff	Total
American	107	105	212
European	33	12	45
Asian	55	47	102
Total	195	164	359

hat is the probability that if a car is from the staff parking lot that it is of uropean origin?

$$P(Eu|Sta) = \frac{12}{164} = .0732$$

hat is the probability that a car is from the staff parking lot given it is of Asian igin?

$$P(Sta|As) = \frac{47}{102} = .4608$$

hat is the probability that a car is from the student parking lot if it is of uropean origin?

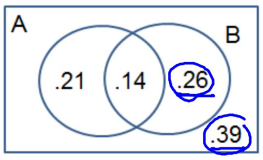
$$P(Stu|Eu) = \frac{33}{45} = .7333$$

origin of car and who owns the car independent?

$$P(Stu) = \frac{195}{359} = .5432 \qquad P(Stu|Eu) = \frac{33}{45} = .7333$$

P(A) = 0.35; P(B) = 0.40; P(A and B) = 0.14

1. $P(A|B) = \frac{.14}{.40} = .35$
2. $P(B|A) = \frac{.14}{.35} = .40$
3. $P(A|\text{not } B) = \frac{.21}{.60} = .35$
4. $P(B|\text{not } A) = \frac{.26}{.65} = .40$
5. $P(\text{not } B|\text{not } A) = \frac{.39}{.65} = .60$
6. ~~Are A and B independent?~~

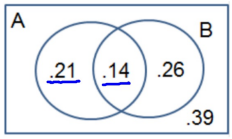


6. P(not A|not B) = 0.39/0.60 = 0.65
7. P(not A| B) = 0.26/0.40 = 0.65
8. P(not B|A) = 0.21/0.35 = 0.60
9. Independent?

   P(A|B) = P(A)

   0.35 = 0.35

   YES



Complete CW #1

7.3 day 2

General Multiplication Rule:

* The probability that events A and B occur:

P(A and B) = P(A) x P(B|A)

P(R|R)

**Special Case: If A and B are independent

P(A and B) = P(A) x P(B)

no replacement

Example 1: *Suppose you have a bag of skittles with 12 red, 8 blue, 7 green, 9 yellow, and 6 orange candies.*

1.What is the probability that you would get 2 red?

$P(R \text{ and } R) = \left(\frac{12}{42}\right)\left(\frac{11}{41}\right) = 0.077 = \frac{22}{287}$

2.What is the probability that you would get a red then a blue?

$P(R \text{ and } B) = \left(\frac{12}{42}\right)\left(\frac{8}{41}\right) = 0.056$

Example 2: Given a standard deck of cards, what is the probability that you would be dealt:

1. Two aces? $P(A \text{ and } A) = \left(\frac{4}{52}\right)\left(\frac{3}{51}\right) = 0.0045$
2. Two hearts? $P(H \text{ and } H) = \left(\frac{13}{52}\right)\left(\frac{12}{51}\right) = 0.059$
3. Four spades? $P(Sp \text{ and } Sp \text{ and } Sp \text{ and } Sp) = \left(\frac{13}{52}\right)\left(\frac{12}{51}\right)\left(\frac{11}{50}\right)\left(\frac{10}{49}\right) = 0.0026$
4. A king followed by an ace? $P(K \text{ and } A) = \left(\frac{4}{52}\right)\left(\frac{4}{51}\right) = 0.006$
5. A king and an ace?

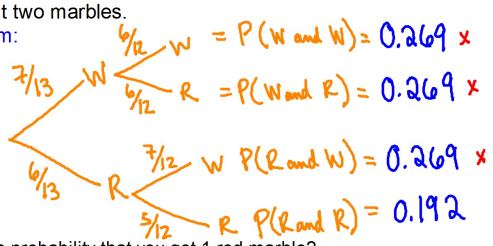
0%

Example 3: Given two standard dice, find the probability that you would roll:

1. Two fives. $P(5 \text{ and } 5) = \left(\frac{1}{6}\right)\left(\frac{1}{6}\right) = 0.0278$
2. A three followed by a 6. $P(3 \text{ and } 6) = \left(\frac{1}{6}\right)\left(\frac{1}{6}\right) = 0.0278$
3. Neither were a 4. $P(4^c \text{ and } 4^c) = \left(\frac{5}{6}\right)\left(\frac{5}{6}\right) =$
4. The first was a 5 and the second was not a 5. $P(5 \text{ and } 5^c) = \left(\frac{1}{6}\right)\left(\frac{5}{6}\right)$
5. A 5 and a 6.

Example 4: In a bag you have 7 white marbles and 6 red marbles and draw out two marbles.

Tree Diagram:



1. What is the probability that you get 1 red marble?

$P(R=1) = P(\text{one } R) = 0.538$

2. What is the probability that you get at least 1 red marble?

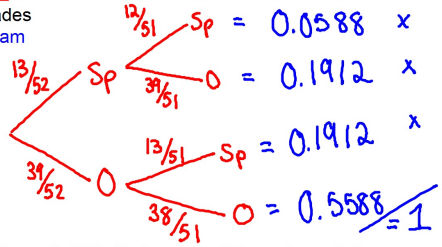
$P(\text{at least 1 } R) = P(R \geq 1) = 0.73$

3. What is the probability that you get at least 1 white marble?

$P(W \geq 1) = 0.807$

Example 5: Standard deck of cards – dealt two cards and interested in getting spades

Tree Diagram



1.What is the probability that you would have 1 spade?

$P(Sp=1) = 0.3824$

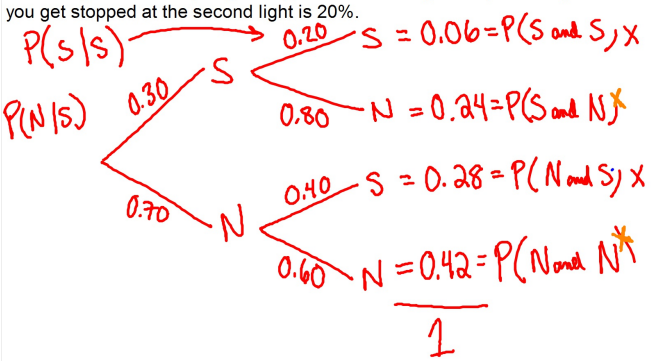
2.What is the probability that you would have 2 spades?

$P(Sp=2) = 0.0588$

3.What is the probability that you would have at least 1 spade?

$P(Sp \geq 1) = 0.4412$

Example 6: On the way to school you have to go through two stop lights. The probability that you will get stopped at the first light is 30%. If you make it through the first light the probability that you will get stopped at the second light is 40%. If you get stopped at the first light the probability that you get stopped at the second light is 20%.



1. What is the probability that you get stopped at least once on the way to school?

$P(S \geq 1) = 0.58$ $P(S_1 | N_2)$

2. What is the probability that you only would have to stop at one light? $= \frac{0.24}{0.66}$

$P(S = 1) = 0.52$

3. What is the probability that you would get stopped at the second light?

$P(\text{stopped at second light}) = 0.34$ $P(1^{st\,c} \text{ and } S)$

4. What is the probability that you wouldn't have to stop at all?

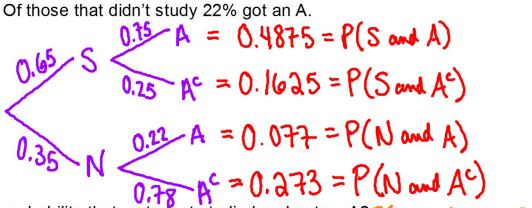
$P(S = 0) = 0.42$

5. What is the probability that if you were stopped at the second light you had to stop at the first light?

$P(S_1 | S_2) = \frac{0.06}{0.34} = 17.6\%$

Example #7

For the last quiz 65% of the students studied for the exam. Of those that studied 75% got an A. Of those that didn't study 22% got an A.



1. What is the probability that a student studied and got an A? $P(S \text{ and } A) = 0.4875$
2. What is the probability that a student didn't study and didn't get an A? $P(N \text{ and } A^c)$
3. What is the probability that a student got an A? $P(A) = 0.5645$
4. What is the probability that if a student got an A they had studied for the quiz?
5. What is the probability that if a student got an A they had not studied for the quiz?
6. What is the probability that a student studied given they didn't get an A on the quiz?

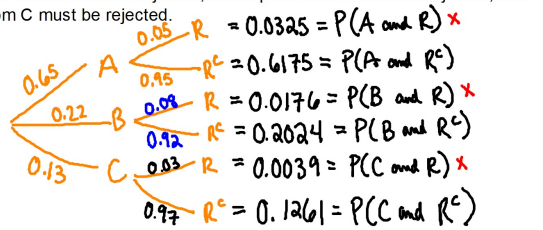
④ $P(S | A) = \frac{0.4875}{0.5645} = 0.864$

⑤ $P(N | A) = \frac{0.077}{0.5645} = 0.136$

⑥ $P(S | A^c) = \frac{0.1625}{0.4355} = 0.373$

Example #8

A manufacturing company imports a specific part from different companies. Company A supplies 65% of the part, company B supplies 22%, and company C supplies the rest of the parts. The parts must be inspected and it has been found that 5% of parts from A must be rejected, 8% of parts from B must be rejected, and 3% of parts from C must be rejected.



1. What is the probability that a part came from company A and was rejected?
2. What is the probability that a part would be rejected? $P(A \text{ and } R) = 0.0325$
3. What is the probability that if a part was rejected that it came from company B?

② $P(R) = 0.054$ ③ $P(B | R) = \frac{0.0176}{0.054} = 0.326$

MORE EXAMPLES:

1) An airline offers discounted tickets to customers who buy tickets early (more than 30 days ahead of time). The company has noticed that 60% of its customers take advantage of the "early-bird" fares, while 25% purchase regular fares, and 15% are "last-minute" customers (less than 48 hours before the flight). They have also figured out that the no-show rate among "early-bird" purchasers is 30%, only 8% among regular fare customers, and 2% among last-minute customers.

a) Create a tree diagram of this situation:

b) What is the probability of being a no-show (overall)?

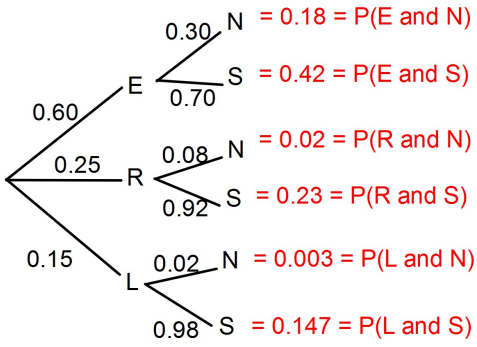
c) What is the probability of being a no-show AND a last minute customer?

d) Given that you have a no-show in a certain seat, what is the probability of that person being a last-minute customer?

e) Given that you have a no-show in a certain seat, what is the probability of that person being a regular-fare customer?

f) Given that you have a person show up for a certain seat, what is the probability of that person being an early-bird customer?

(a)



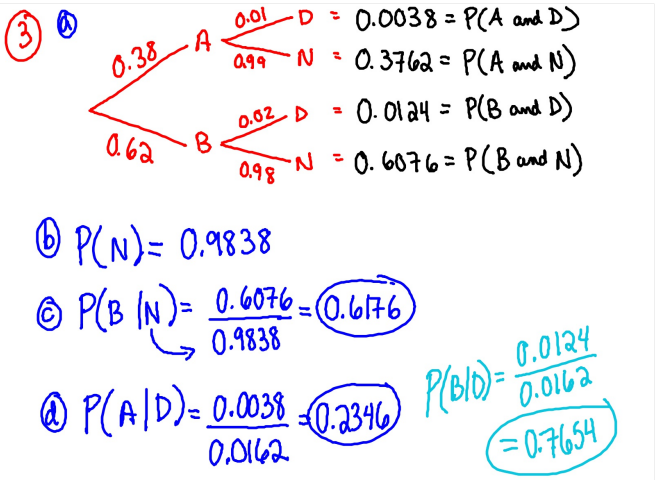
b) P(N) = 0.203

c) P(N and L) = 0.003

d) P(L |N) = 0.003 / 0.203 = 0.0148

e) P(R|N) = 0.02 / 0.203 = 0.0985

f) P(E|S) = 0.42 / 0.797 = 0.527



2) Leah is flying home (from Boston to Denver), but she has a connecting flight in Chicago. The probability that Leah's first flight leaves on time is 15%. Otherwise it is delayed. If her first flight is on time, the probability that her luggage will make the connecting flight in Chicago is 95%. If her first flight is delayed, the probability that her luggage will make the connecting flight in Chicago is 65%

a. Draw the tree diagram
b. What is the probability that her luggage will make the connecting flight?
c. You pick up Leah at the airport and find out that her luggage did not make it (didn't make the connecting flight). What is the probability that her first flight was delayed?
d. Leah tells you that her luggage did make the connecting flight. What is the probability that her flight was not delayed?